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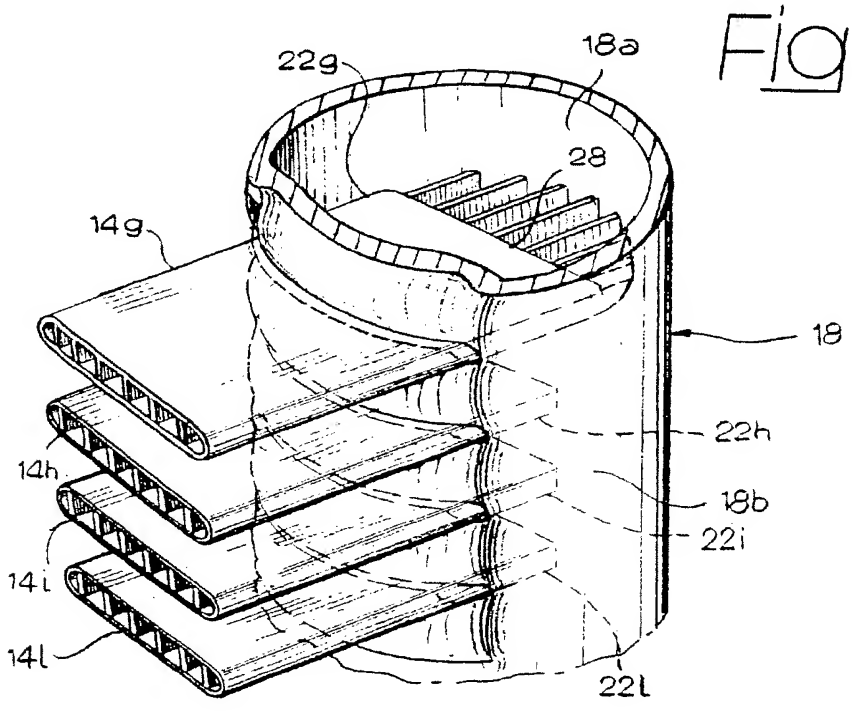
(54) Condenser for vehicle air-conditioning systems

(57) A condenser for air conditioning systems for vehicles, comprising a pair of distributors (16, 18) and a plurality of tubes (14a-14n) extending between the distributors and having end portions (22a-22n) inserted into corresponding apertures (20) formed in the lateral walls of the distributors (16, 18). At least one of said tubes (14a-14n) has an end portion (22d, 22l, 22g) which divides the respective distributors (16, 18) in two chambers (16a, 16b, 16c, 18a, 18b). Said end portion (22d, 22l, 22g) has an aperture (28) in its lateral wall which puts the tube (14d, 14c, 14l) in fluid communication with only one of said chambers (16a, 16b, 16c, 18a. 18b).

Fig_5



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Description

[0001] The present invention relates to a condenser for air conditioning systems for vehicles, of the type comprising a plurality of tubes extending between a pair of distributors, the tubes having end portions inserted into corresponding apertures formed in the lateral walls of the distributors.

[0002] More specifically, the invention relates to a condenser of the so-called "parallel flow" type, in which the tubes are divided in a certain number of groups and wherein the different groups are connected in series to each other with reference to the direction of the heat exchanger fluid. The circulation of the fluid of the type "parallel flow" is obtained by arranging inside the distributors a plurality of baffles which divide the internal volume of the distributors in a plurality of chambers, communicating with respective end portions of the tubes.

[0003] The step of inserting the baffles in the distributors is a complicated and expensive operation which requires a specific station in an automatic line for assembling the condensers.

[0004] The object of the present invention is to provide a heat exchanger of the type mentioned above which overcomes said drawback.

[0005] According to the present invention, this object is achieved by a condenser having the features forming the subject of the main claim.

[0006] Characteristics and advantages of the condenser according to the present invention will become clear in the course of the detailed description which follows, given purely by way of non limiting example, with reference to the attached drawings, in which:

- figure 1 is a schematic view showing the distribution of the flow of fluid in the condenser according to the present invention,
- figure 2 is a partial cross-section in a greater scale of the part indicated by the arrow II in figure 1,
- figure 3 is a cross-section taken along the line III-III of figure 2 in an intermediate step of the assembly procedure,
- figure 4 is a cross-section similar to figure 3, at the end of the assembly procedure,
- figure 5 is a partial perspective view of the part indicated by the arrow V in figure 2,
- figure 6 is a schematic cross-section showing a second embodiment of the present invention,
- figure 7 is a schematic cross-section similar to figure 6, showing a third embodiment of the present invention,
- figure 8 is a perspective view of the part indicated by arrow VIII in figure 7,
- figure 9 is a variant of the embodiment shown in figure 7,
- figure 10 is a partial perspective view of the part indicated by the arrow X in figure 9, and
- figure 11 is a cross-section taken along the line XI-XI of figure 10

[0007] With reference to the drawings, the reference numeral 10 indicates a condenser for air conditioning systems for vehicles. The condenser 10 comprises a heat exchanger core 12 including a plurality of tubes parallel to each other indicated in figure 1 at 14a-14n. The tubes 14 are of a type commonly used for the production of condensers assembled in accordance with the technology of braze-welding in oven. They are made of aluminium or its alloys and are manufactured by extrusion. Each tube 14 has a flat cross-section and has internally a plurality of longitudinal ribs and channels. Undulated fins (not shown) are arranged between each pair of adjacent tubes and are fixed to the tubes in a way per se known during the braze-welding step.

[0008] A pair of distributors 16, 18 formed by tubular elements closed at their ends are placed at opposite ends of the heat exchanger core 12. Each distributor 16, 18 has on its lateral wall a plurality of through apertures 20 in which respective end portions 22a-22n of the tubes 14a-14n are inserted. Each distributor 16, 18 is divided in a plurality of chamber in series to each other, indicated at 16a, 16b, 16c and 18a, 18b.

[0009] Referring to figure 1, the flow of the coolant fluid enters in the condenser 10 though an inlet fitting 24 and from chamber 16a of the distributor 16 reaches chamber 18a of the distributors 18 passing through the tubes 14a, 14b, 14c and 14d. From chamber 18a, the fluid reaches the chamber 14b through the tubes 14e, 14f and 14g. In the same manner, from a chamber 16b the flow of fluid reaches chamber 18b through the tubes 14h, 14i and 14l and from chamber 18b, through the tubes 14m and 14n, the flow reaches the chamber 16c which communicates with an outlet fitting 26.

[0010] According to the present invention, the baffles which divide from each other the chambers 16a, 16b, 16c and 18a, 18b are formed by end portions of the tubes. In the example shown in the figures, the tubes 14d, 14g and 14l are longer than the other tubes so that their end portions 22d, 22g and 22l penetrate the whole width of a respective distributor 16, 18 forming a transversal baffle dividing two adjacent chambers.

[0011] As shown in figures 2 to 5, the end portion of each tube forming a transversal baffle has an aperture 28 in its lateral wall, which puts the tube in fluid communication with only one of the chambers formed by such end portion and, more precisely, with the upstream chamber, with reference to the direction of the flow of coolant. In the embodiment shown in the figures, the aperture 28 is formed by removing the terminal portion of one of the flat walls of the tube.

[0012] In the embodiment shown in figures 3, 4 and 5, the distributors 16, 18 have a circular cross-section. Therefore, for forming a transversal baffle, the end portions 22d, 22l and 22g are formed with rounded head portions 30, with a radius identical to that of the internal wall of the distributor. However, as shown in figure 3,

after having inserted the end portion of the tube in the distributor small apertures are formed on the sides of the tube, due to the play existing between the straight sides of the tube 14 and the arcuate internal wall of the distributor 18. For closing such apertures and sealing the chambers, the outer walls of the distributors 18 are locally compressed in correspondence with the zones indicated at 32, as shown by the arrows F in figure 4. The walls of the distributor are plastically deformed and the end portion of the tube contacts the internal wall of the distributor 18 along its entire perimeter. Each end portion is then welded to the internal wall of the distributor during the step of braze-welding in oven of the whole condenser.

[0013] For avoiding the step of local squashing of the walls of the distributors in correspondence with the end portions forming the baffles, it is possible to use distributors 16, 18 having in cross-section the shape shown in figure 6, with two parallel walls 34 and one arcuate wall 36. In this way, the end portion closes the whole cross section of the distributor without the need for carrying out localised deformation.

[0014] In a further variant of the present invention, if it is desirable to avoid the step of shaping into an arcuate profile the end portion of the tubes intended to forms the baffles, it is possible to use distributor with a cross-section having the shape shown in figure 7, that is with two straight sides 34 and one straight bottom wall 40 against which the straight head edge 38 of the end portions forming the baffles abut.

[0015] As shown in figures 7 and 8, it is not necessary that the aperture on the lateral wall of the end portion extend to the end of the tube. A small strip-shaped aperture as shown in figures 7 and 8 is sufficient for establishing a fluid communication between the tube and the upstream chamber.

[0016] A further variant of the solution shown in figures 7 and 8 is shown in figures 9 to 11, in which the aperture 38 on the lateral wall of the end portion is formed by cutting the tube along a plane forming an angle a with respect to the longitudinal axis of the tube, so as to form an inclined front edge.

Claims

1. A condenser for air conditioning systems for vehicles, comprising a plurality of tubes (14a-14n) extending between a pair of distributors (16, 18), the tubes having end portions (22a-22n) inserted into corresponding apertures (20) formed in the lateral walls of the distributors (16, 18), wherein separating means are arranged inside at least one of said distributors for dividing its internal volume into at least two chambers (16a, 16b, 16c, 18a, 18b) communicating with respective end portions of the tubes, characterized in that at least one of said tubes (14a-14n) has one end portion (22d, 221, 22g) which divides the respective distributor (16, 18) in two chambers (16a, 16b, 16c, 18a, 18b) said end portion (22d, 221, 22g) having an aperture (28) in its lateral wall which puts the tube (14d, 14g, 141) in fluid communication with only one of said chambers (16a, 16b, 16c, 18a, 18b).

2. A condenser according to claim 1, characterized in that said tubes (14a-14n) have a flat cross section and in that said apertures (28) are formed by removing a portion of one of said flat lateral walls in correspondence with the end portions (22d, 22g, 221) which divide the internal volume of the distributors (16, 18).

3. A condenser according to claim 1, characterized in that said distributors (16, 18) have circular cross sections and in that the front edges (30) of said end portion (22d, 22g, 221) which separate the internal volume of the distributors have a rounded shape with a radius substantially equal to the radius of the internal surface of the distributors (16, 18).

4. A condenser according to claim 3, characterized in that after having inserted said end portions (22d, 22g, 22l) inside said distributors (16, 18) the lateral walls of the distributors are locally deformed in zones (32) placed in correspondence with the sides of said end portions which divide the internal volume of the distributors.

5. A condenser according to claim 1, characterized in that said distributors (16, 18) have a cross section including two parallel flat walls (34) spaced-out from each other by a distance equal to the width of said tubes (14).

6. A condenser according to claim 5, characterized in that the distributors (16, 18) have a third flat wall (40) orthogonal to said parallel flat walls (34), and in that the front edges of the end portions which divide the internal volume of the distributor lay on a plane orthogonal to the axis of the tube.

7. A condenser according to claim 1, characterized in that said aperture (28) in the lateral wall of the tube is formed by a cut of the end of the tube along a plane inclined with respect to the longitudinal axis of the tube.

Fig_1

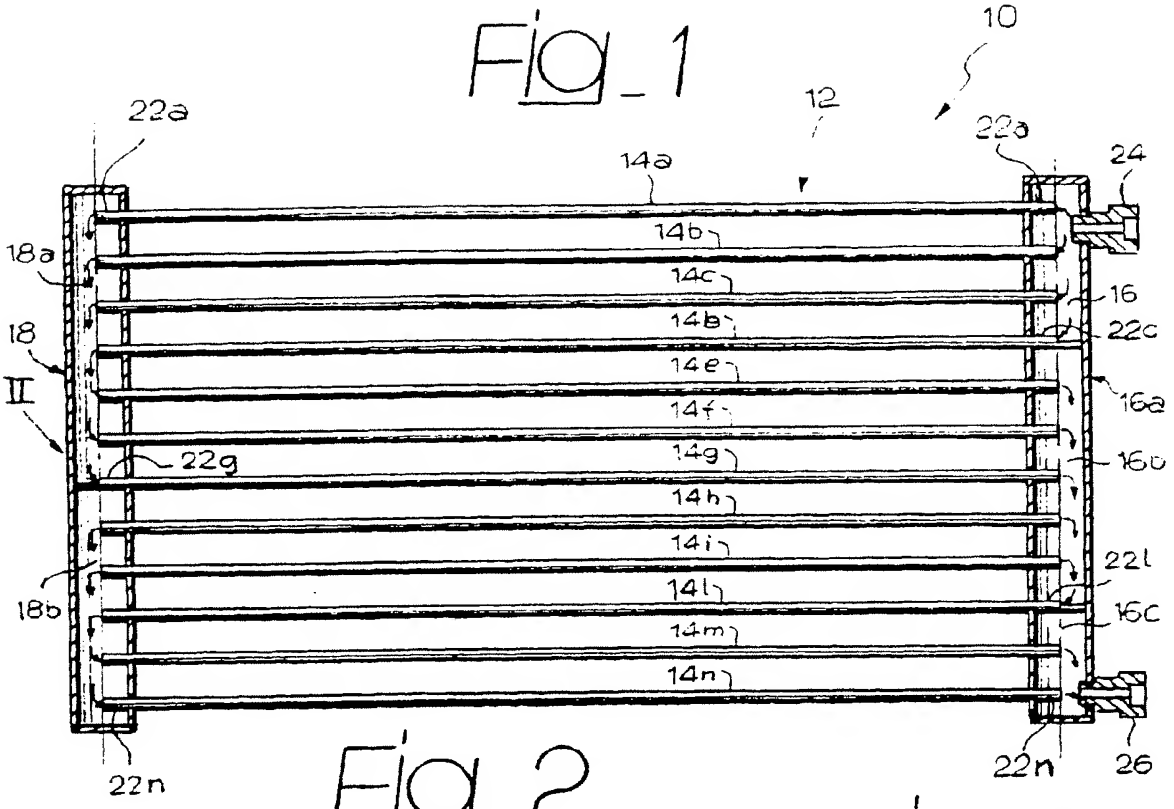


Fig_2

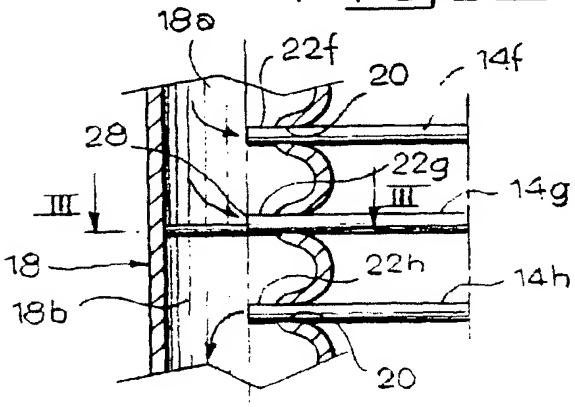


Fig_3

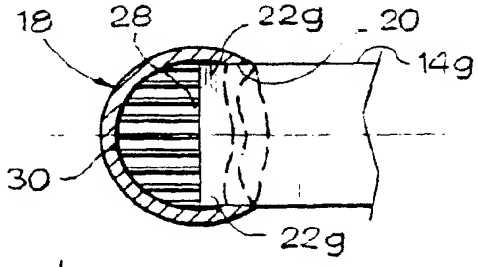


Fig_4

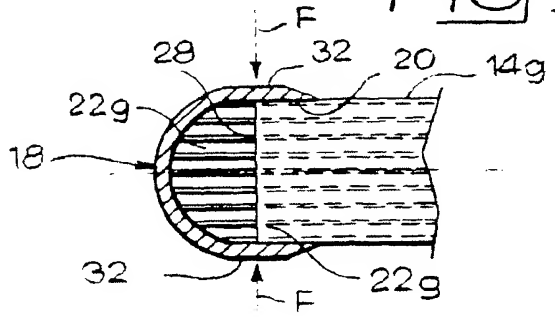


Fig_5

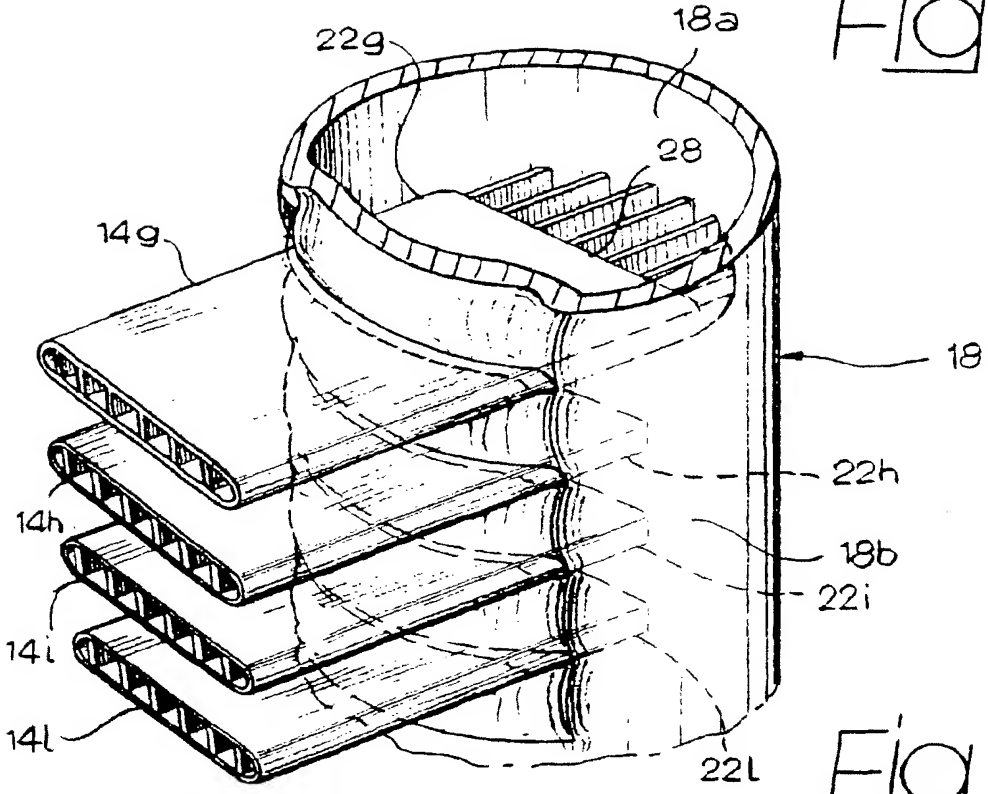


Fig_6

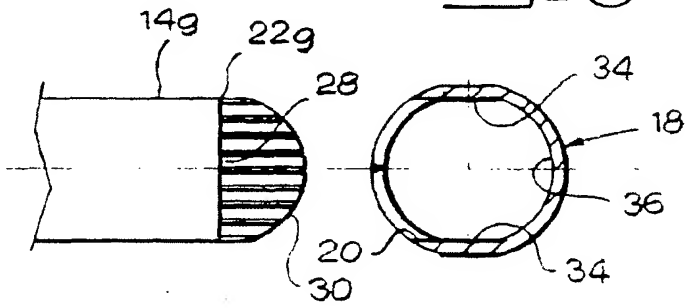
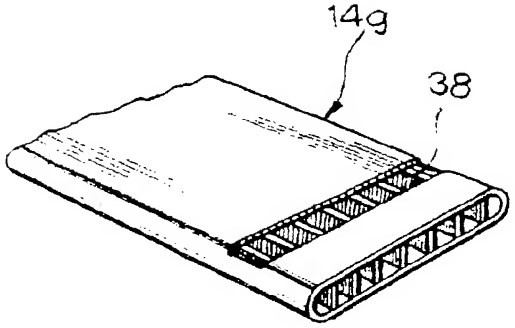


Fig_8



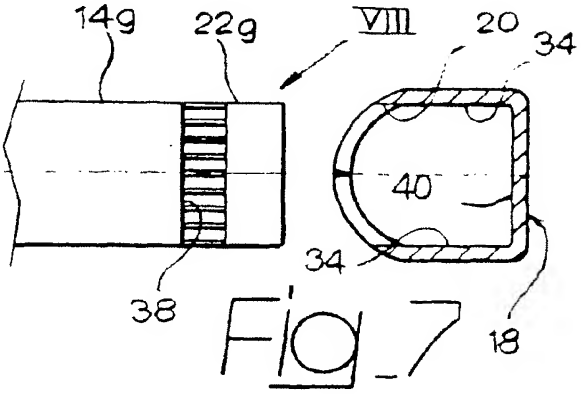


Fig_7

Fig. 9

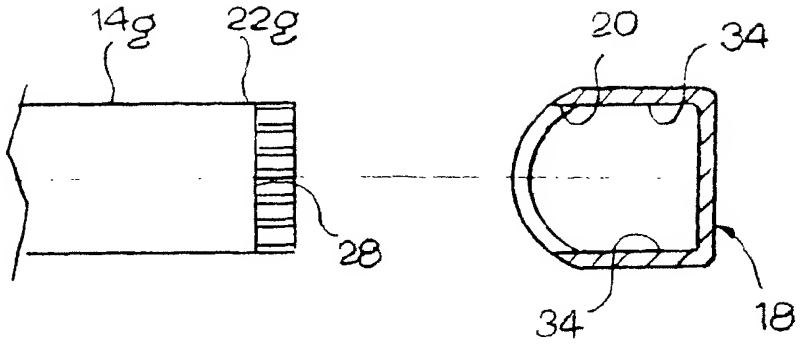


Fig. 10

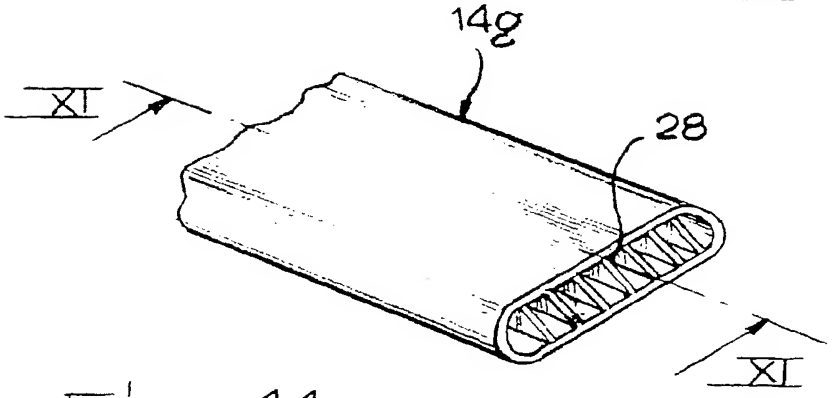
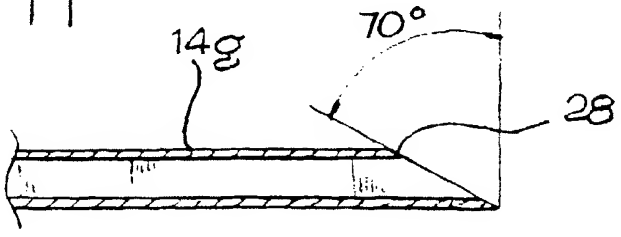


Fig. 11



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EUROPEAN SEARCH REPORT

Application Number
EP 99 83 0758

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 March 2000	Mootz, F

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